# Restoration of the Salton Sea

**Volume 2: Embankment Designs and Optimization Study** 

Appendix 2D: Risk Analysis

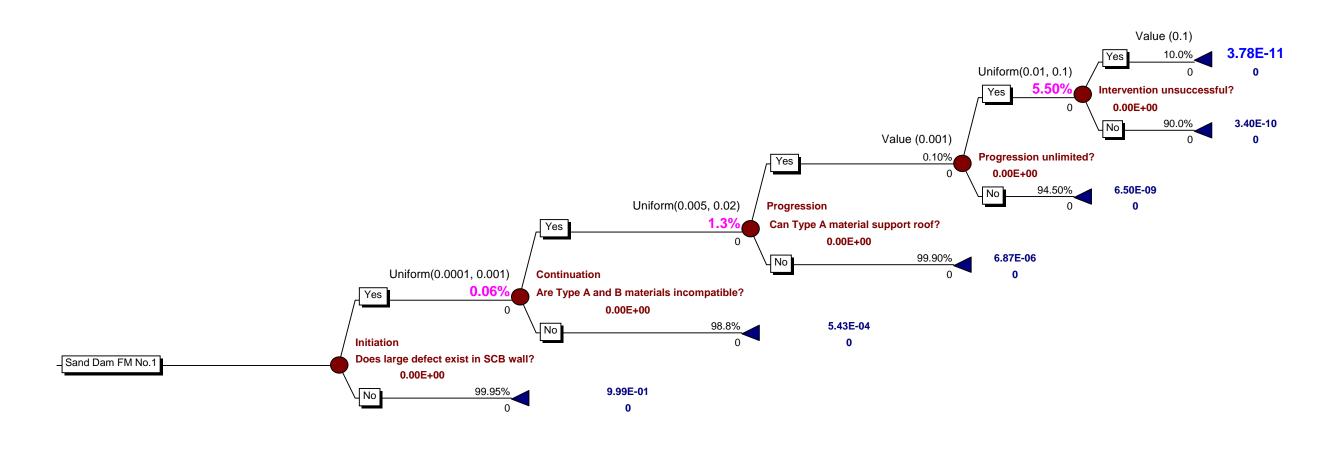
**Attachment B: Event Trees** 

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# Sand Dam Embankment with Stone Columns FM No. 1 Static - Internal Erosion (Piping) of Embankment

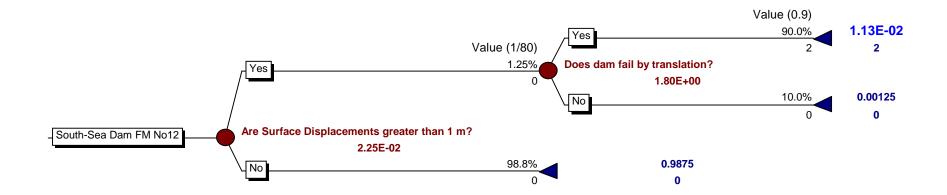
Annualized Loss of Life (ALL) 0.00E+00 Annualized Probability of Failure (APF) 3.78E-11



Annualia Probabili Failur	ty of	Annualized Loss of Life
3.78E- <sup>-</sup>	11	0.00E+00

South-Sea Dam
FM No. 12 Seismic - Offset and Translation of Embankment

Annualized Loss of Life (ALL) 2.25E-02 Annualized Probability of Failure (APF) 1.13E-02

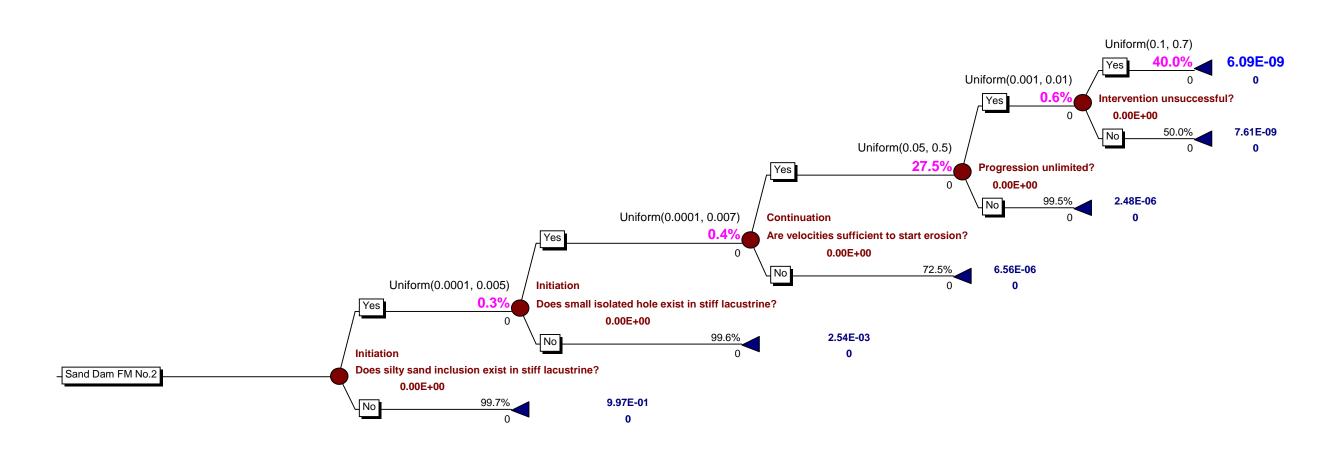


Low Bound	Best Estimate	Upper Bound
0.28	1.5	3.5

Annualized Probability of Failure	Annualized Loss of Life
1.13E-02	2.25E-02

# Sand Dam Embankment with Stone Columns FM No. 2 Static - Internal Erosion of Foundation Materials

Annualized Loss of Life (ALL) 0.00E+00 Annualized Probability of Failure (APF) 6.09E-09

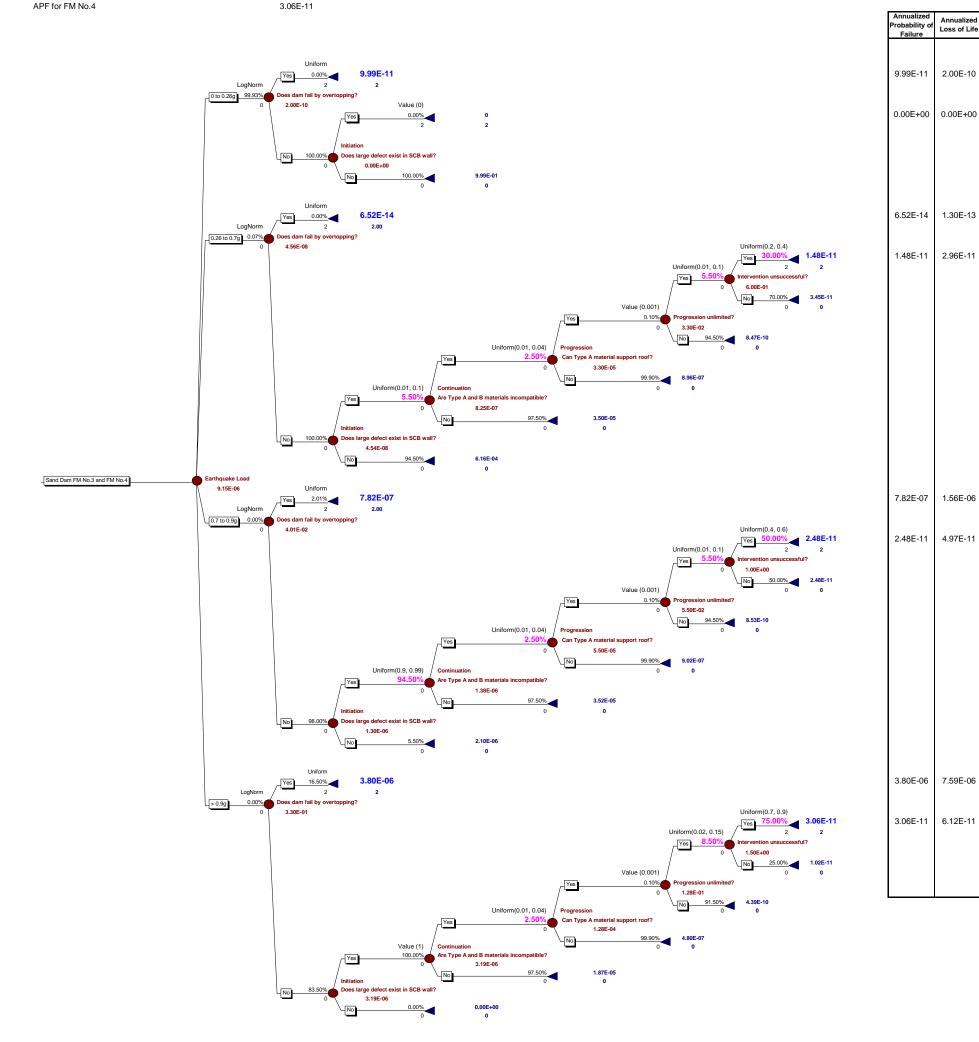


Annualized Probability of Failure	Annualized Loss of Life
6.09E-09	0.00E+00

# Sand Dam Embankment with Stone Columns FM No. 3 Seismic - Deformation and Overtopping of Embankment FM No.4 Seismic - Deformation and Internal Erosion of Embankment

Annualized Loss of Life (ALL) Annualized Probability of Failure (APF) ALL for FM No.4 APF for FM No.4

Failure mode FM No.3 is governing Failure mode FM No.3 is governing 3.80E-06



Low Bound	Best Estimate	Upper Bound
0.28	1.5	3.5

Sand Dam Embankment with Stone Columns FM No. 3 Seismic - Deformation and Overtopping of Embankment FM No.5 Seismic - Deformation and Internal Erosion of Foundation

Annualized Loss of Life (ALL) Annualized Probability of Failure (APF) ALL for FM No.5 APF for FM No.5

7.59E-06 3.80E-06 1.60E-07 7.98E-08

Failure mode FM No.3 is governing Failure mode FM No.3 is governing

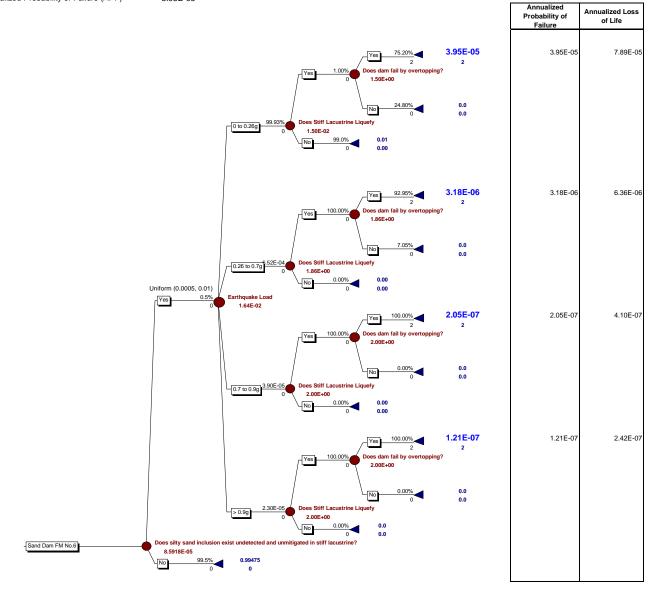
FM No.5	7.98E-08	Annualized	
		Annualized Probability of Failure	Annualized Loss of Life
	Uniform 9.99E-11 2 2	9.99E-11	2.00E-10
	1.60E-07   1.60E-03   1.60E-03   1.60E-05   1.60E-05   1.60E-05   1.60E-05   1.60E-07   1.60E-03	7.98E-08	1.60E-07
	Uniform    Composition   Compo	6.52E-14 5.21E-11	6.52E-14 1.04E-10
	Uniform(0.05, 0.5)  Uniform(0.001, 0.07)  Ves  1.642E-03  Uniform(0.001, 0.05)  Does small isolated hole exist in stiff lacustrine?  6.26E-05  Initiation  Does silty sand inclusion exist in stiff lacustrine?  1.60E-06  Initiation  Does silty sand inclusion exist in stiff lacustrine?  1.60E-07  No  99.75%  6.50E-04  0  Earthquake Load		
_ Sand Dam FM No.3 and FM No.5	9.31E-06 Uniform    Yes	7.82E-07	1.56E-06
	LogNom 2 2  Does dam fail by overtopping?  4.01E-02  Uniform(0.05, 0.5)  Uniform(0.05, 0.5)  Uniform(0.05, 0.5)  Very 70.0% 3.05E-12  Intervention unsuccessful?  1.7E-03  Very 70.0% 3.05E-12  Intervention unsuccessful?  1.7E-03  Very 70.0% 2.18E-12  Intervention unsuccessful?  1.7E-03  No	3.05E-12	6.10E-12
	Uniform (Yes) 16.50% 3.80E-06	3.80E-06	7.59E-06
	LogNorm 2 2 Does dam fail by overtopping?  3.30E-01  Uniform(0.05, 0.5)  Ves 70.00%  1.53E-12 2 Intervention unsuccessful? 1.17E+00 No 50.00% 1.10E-12 0 0 Registront of the progression unlimited? 6.42E-03	1.53E-12	3.07E-12
	Uniform(0.001, 0.07)  Ves 3.55%  Uniform(0.001, 0.005)  Initiation  Does small isolated hole exist in stiff facustrine?  6.26E-05  No 99.45%  1.26E-09  Initiation  Does sity sand inclusion exist in stiff facustrine?  1.60E-07  1.60E-07  1.92E-05  0  1.92E-05		

Low Bound	Best Estimate	Upper Bound
0.28	1.5	3.5

### Sand Dam Embankment with Stone Columns

### FM No. 6 Seismic - Liquefaction of Stiff Lacustrine, Seismic Deformation and Overtopping of Embankment

Annualized Loss of Life (ALL) 7.89E-05 Annualized Probability of Failure (APF) 3.95E-05

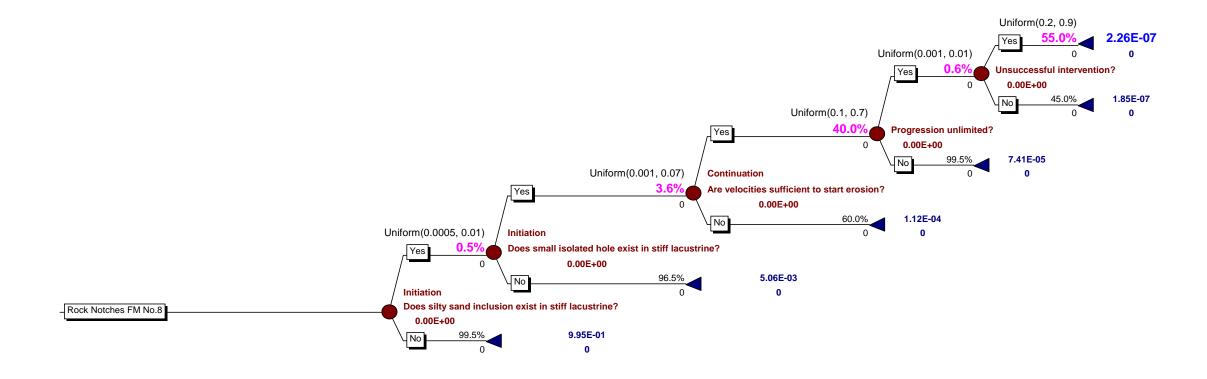


Low Bound	Best Estimate	Upper Bound
0.28	1.5	3.5

# Rockfill Dam with Rock Notches FM No. 8 Static - Internal Erosion of Foundation Materials

Annualized Loss of Life (ALL)
Annualized Probability of Failure (APF)

0.00E+00 2.26E-07



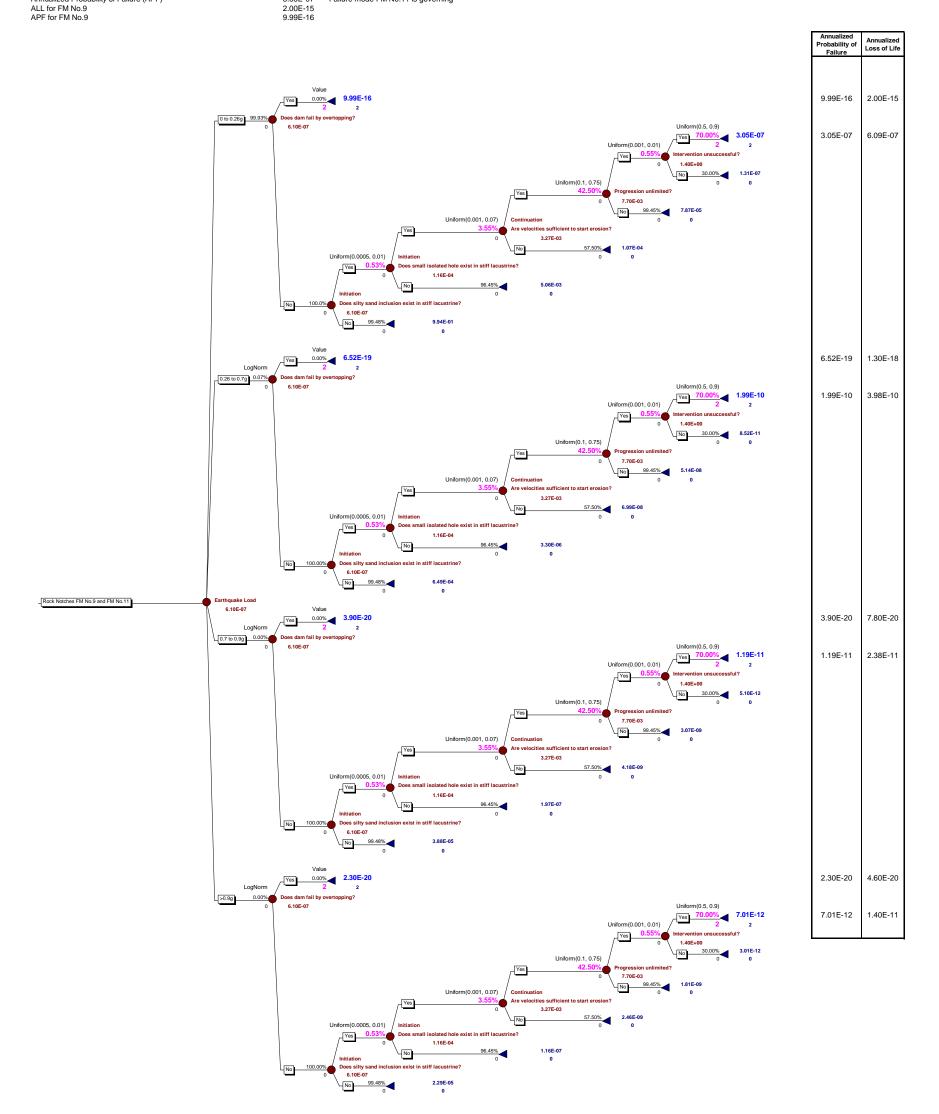
Annualized Probability of Failure	Annualized Loss of Life
2.26E-07	0.00E+00

### Rockfill Dam with Rock Notches

FM No. 9 Seismic - Deformation and Overtopping of Embankment FM No.11 Seismic - Deformation and Internal Erosion of Foundation Materials

Annualized Loss of Life (ALL) Annualized Probability of Failure (APF) ALL for FM No.9 APF for FM No.9

Failure mode FM No.11 is governing Failure mode FM No.11 is governing 6.09E-07 3.05E-07



LOL Estimates (Pert Distribution)			
Low Bound	Best Estimate	Upper Bound	
0.28	1.5	3.5	